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WASHINGTON, DC 20004-2128

EXAMINER
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REPKO, JASON MICHAEL

ART UNIT	PAPER NUMBER
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2628

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/757,547

Applicant(s)

AILA ET AL.

Examiner

Jason M. Repko

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 21 May 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 January 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
  - 2) ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. **Claims 1, 2, 4, 5, 7 and 8 rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,480,205 to Greene et al.**

3. With regard to claim 1, Greene et al discloses “a method for testing visibility of graphics primitives, said method comprising the steps of:

a. computing the geometry of graphics primitives (*lines 25-28 of column 7: "FIG. 1 illustrates a preferred embodiment of the present invention in which the numeral 100 identifies a graphics system for rendering geometric models represented by polygons. The graphics system includes a scene manager 110 which sends scene geometry to a geometric processor 120."*);

b. testing the visibility of the computed primitives in a first visibility test (*lines 13-17 of column 12: "Considering now the steps of procedure Process Batch of Boxes 700 (FIG. 7), in step 702, the scene manager 110 tests each box in the batch to see if it is occluded by the tip of the z-pyramid using procedure Is Box Occluded by Tip 1900, which will be discussed later."*);

- c. storing occlusion data of the visible primitives for a next comparison based on said first visibility test (*lines 20-24 of column 12: "Using procedure Transform & Set Up Polygon 900, the geometric processor 120 transforms each face to perspective space and performs the other geometric computations required to create the tiling record for the face, which is then output to the culling stage 130 (step 704)."*);
- d. computing the occlusion data for each visible primitive (*line 66 of column 13 through of line 1 of column 14: "Next, step 910 creates a tiling record for the polygon from the geometric information computed in the preceding steps and outputs this record to the culling stage 130."*);
- e. collecting said primitives to an occlusion data buffer (*lines 7-9 of column 14: "Geometric information computed for a polygon by Transform & Set Up Polygon 900 is stored in a tiling record 5000 containing the following information."*, wherein said occlusion data buffer stores primitives formed by at least three vertices (*lines 49-50 of column 13: "First, step 902 transforms the polygon's vertices to perspective space."*; *Figure 14 shows a polygon with three vertices; lines 16-19 of column 14: "...3. number of edges ("n"); 4. coefficients  $(A_1, B_1, C_1)$ ,  $(A_2, B_2, C_2)$ , . . . ,  $(A_n, B_n, C_n)$  of edge equations (polygon has  $n$  edges); and 5. coefficients  $(A_p, B_p, C_p)$  of plane equation..."*);
- f. testing the visibility of the collected primitives in a second visibility test with said computed occlusion data; and rasterizing visible primitives of the second visibility test to produce a screen of the scene to be rendered (*lines 32-35 of column 17: "Next, step 1308 determines whether the plane of the polygon is occluded within the current cell. The polygon's plane equation, which is stored in the tiling record, has the form..."*; *lines 52-*

*54 of column 12: "In step 720, the list of polygons associated with a visible box is rendered with procedure Render Polygon List 300. "; lines 50-58 of column 9: "In step 304 of Render Polygon List 300, the culling stage 130 processes these records using procedure Tile Polygon List 800, which tiles each polygon into the z-pyramid 170 and determines whether it is visible. For each visible polygon, the culling stage 130 sends the corresponding rendering record on to the z-buffer renderer 140, which renders the polygon into the output image 150 using conventional z-buffering (step 306).").*

4. One of ordinary skill in the art would recognize that the tiling record stores "primitives formed by at least three vertices" from lines 62-63 of column 13 (" Next, step 908 computes the equation of the plane of the polygon and the equation of each edge of the polygon.") in view of figure 14 showing a primitive with 3 vertices coupled with the fact that the tiling record stores information defining the polygon as shown in lines 16-19 of column 14. Greene et al states that a polygon can be defined by edge equations in lines 63-65 of column 1: "The memory system in this [example Pixel-Planes] architecture takes as input a polygon defined by its edge equations..."

5. With regard to claim 2, Greene et al discloses "the steps of discarding hidden primitives of the first visibility test" (*lines 16-17 of column 12: "Occluded boxes are removed from the batch."*).

6. With regard to claim 4, Greene et al discloses "after said first visibility test, collecting occlusion data of the visible primitives belonging to the frame to be rendered to the occlusion data buffer" (*lines 17-24 of column 12: "Next, the scene manager 110 sends records for the front faces of each box in the batch to the geometric processor 120. Using procedure Transform & Set*

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*Up Polygon 900, the geometric processor 120 transforms each face to perspective space and performs the other geometric computations required to create the tiling record for the face, which is then output to the culling stage 130 (step 704)."). One of ordinary skill in the art would recognize the visible primitives belong to a frame to be rendered from lines 50-58 of column 9.*

7. With regard to claim 5, Greene et al discloses "wherein after said visibility test, collected a predefined amount of occlusion data of the primitives to the occlusion data buffer" (*lines 16-19 of column 14: "...3. number of edges ("n"); 4. coefficients  $(A_1, B_1, C_1)$ ,  $(A_2, B_2, C_2)$ , . . . ,  $(A_b, B_m, C_n)$  of edge equations (polygon has n edges); and 5. coefficients  $(A_p, B_p, C_p)$  of plane equation..."*).

One of ordinary skill in the art would recognize that the tiling record inherently establishes the predefined amount of occlusion data.

8. With regard to claim 7, Greene et al discloses "further comprising the step of testing visibility of an object before the geometry processor by a bounding volume method" (*line 67 of column 6 through line 1 of column 7: "The term bounding box, sometimes shortened to box, is applied to bounding volumes of any shape..."*; *lines 63-66 of column 11: "Within Process Batch of Boxes 700, the scene manager 110 culls boxes which are occluded by the "tip" of the z-pyramid and sends the remaining boxes to the geometric processor 120..."*).

9. With regard to claim 8, Greene et al discloses "the step of testing the visibility of the primitive in the first and the second visibility test with a low resolution Z-buffer" (*lines 63-66 of column 11 (emphasis added): "Within Process Batch of Boxes 700, the scene manager 110 culls boxes which are occluded by the "tip" of the z-pyramid and sends the remaining boxes to the geometric processor 120..."*; *lines 50-58 of column 9: "In step 304 of Render Polygon List 300, the culling stage 130 processes these records using procedure Tile Polygon List 800, which tiles*

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*each polygon into the z-pyramid 170 and determines whether it is visible. For each visible polygon, the culling stage 130 sends the corresponding rendering record on to the z-buffer renderer 140, which renders the polygon into the output image 150 using conventional z-buffering (step 306)."; see also lines 49-51 of column 7).* Greene et al defines a z-pyramid with levels analogous to a low resolution z-buffer in lines 56-62 of column 6:

*A cell in the z-pyramid is the region of the screen corresponding to a value in the z-pyramid. Preferably, at the finest level of the z-pyramid, cells correspond to depth samples depths at pixels when point sampling and depths at subpixel samples when oversampling. At coarser levels of the z-pyramid, cells correspond to square regions of the screen, as with image pyramids in general.*

Furthermore, Applicant's attention is directed to lines 25-29 of column 27:

*The tip of the pyramid is in fact a low-resolution z-pyramid, that is, a z-pyramid with lower resolution than the z-pyramid 170 maintained by the culling stage 130, or if there is no separate culling stage, than the z-pyramid maintained by a hierarchical rendering stage [emphasis added].*

### ***Claim Rejections - 35 USC § 103***

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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11. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

12. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

13. **Claims 3, 9-12 and 14-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,480,205 to Greene et al in view of Gernot Schaufler, Julie Dorsey, Xavier Decoret, François X. Sillion, "Conservative Volumetric Visibility with Occluder Fusion," July 2000, Proceedings of the 27th Annual Conference On Computer Graphics and Interactive Techniques, p.229-238 (Schaufler et al).**

14. With regard to claim 9, Greene et al discloses "a system for testing visibility of graphics primitives of a scene to be rendered, said system comprising:

- g. a geometry processor that computes geometry of three-dimensional scenes and objects (120 shown in Figure 1; lines 25-28 of column 7: "FIG. 1 illustrates a preferred



*embodiment of the present invention in which the numeral 100 identifies a graphics system for rendering geometric models represented by polygons. The graphics system includes a scene manager 110 which sends scene geometry to a geometric processor 120."");*

h. a z-buffer component for storing visibility information of pixels of the computed geometry (180 shown in Figure 1; lines 33-39 of column 7: "Both the culling stage 130 and the z-buffer renderer 140 have their own dedicated depth buffers, a z-pyramid 170 in the case of the culling stage 130 and a conventional z-buffer 180 in the case of the z-buffer renderer 140. Preferably, the z-buffer 180 and the finest level of the z-pyramid 170 have the same resolution and the same arrangement of image samples");

i. a first visibility test module that tests visibility of the computed geometry based on values stored in the z-buffer (110 shown in Figure 1; lines 13-17 of column 12:

*"Considering now the steps of procedure Process Batch of Boxes 700 (FIG. 7), in step 702, the scene manager 110 tests each box in the batch to see if it is occluded by the tip of the z-pyramid using procedure Is Box Occluded by Tip 1900, which will be discussed later."");*

j. a unit that computes occlusion data from primitives determined visible in the first visibility test (lines 20-24 of column 12: "Using procedure Transform & Set Up Polygon 900, the geometric processor 120 transforms each face to perspective space and performs the other geometric computations required to create the tiling record for the face, which is then output to the culling stage 130 (step 704).");

- k. an occlusion data buffer that stores the computed occlusion data, wherein said occlusion data buffer stores primitives formed by at least three vertices (*lines 7-9 of column 14: "Geometric information computed for a polygon by Transform & Set Up Polygon 900 is stored in a tiling record 5000 containing the following information."*); and
- l. a second visibility test module that tests visibility of the stored occlusion data (*lines 50-58 of column 9: " For each visible polygon, the culling stage 130 sends the corresponding rendering record on to the z-buffer renderer 140, which renders the polygon into the output image 150 using conventional z-buffering (step 306)."*).
- m. a pixel processor comprising a rasterizer and frame buffer for producing a screen of a scene to be rendered from visible primitives output from the second visibility test module (*lines 50-58 of column 9: "In step 304 of Render Polygon List 300, the culling stage 130 processes these records using procedure Tile Polygon List 800, which tiles each polygon into the z-pyramid 170 and determines whether it is visible. For each visible polygon, the culling stage 130 sends the corresponding rendering record on to the z-buffer renderer 140, which renders the polygon into the output image 150 using conventional z-buffering (step 306)."*).
15. Greene et al does not expressly disclose "an occlusion fusion unit." Schaufler et al discloses using occlusion fusion in the sixth paragraph of section 1:

*We show that hidden regions of space are valid blockers and that any opaque blocker can be extended into such regions of space. This effectively combines — fuses [32] — one*

*blocker with all the other blockers that have caused this region to be occluded and results in a dramatic improvement in the occlusions detected.*

16. With regard to claims 3 and 15, Schaufler et al discloses an “occlusion fusion cache” (*1<sup>st</sup> paragraph of section 4: “Our subdivisions of space are a quadtree in 2D and 2 1/2D, and an octree in 3D.”; 1<sup>st</sup> paragraph of section 4.5: “Occlusion of the original objects is determined by inserting their bounding boxes into the tree and checking that all the voxels they overlap are hidden.”*). One of ordinary skill in the art would recognize that the memory storing the octree in 3D as disclosed by Schaufler is analogous to an occlusion fusion cache as the octree stores occlusion fusion information (*Figure 19 shows the memory requirements for an octree*).

17. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to incorporate an occlusion fusion unit and cache in the system disclosed by Greene et al. The motivation for doing so would have been to improve the computation performance of visibility determination as suggested by Schaufler et al in the Abstract (emphasis added): “We demonstrate the applicability to visibility preprocessing for real-time walkthroughs and to shadow-ray acceleration for extended light sources in ray tracing, with significant acceleration in both cases.” Therefore, it would have been obvious to combine Greene et al with Schaufler to obtain the invention specified in claim 3, 9 and 15.

18. Claims 10, 11, 12 are 14 recite the limitations similar in scope to those of claims 2, 4, 5, and 7, respectively. The limitations recited claims 2, 4, 5, and 7 were shown to be met by the system disclosed by Greene et al. Therefore, claims 10, 11, 12 are 14 met by the combination of Greene et al and Schaufler et al, wherein Greene et al discloses the limitations recited in claims 10, 11, 12 are 14.

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19. Claim 16 is met by the combination of Greene et al and Schaufler et al, wherein Greene et al discloses "the Z-buffer is connected to the first visibility test module and is a low resolution Z-buffer" (*lines 63-66 of column 11 (emphasis added): "Within Process Batch of Boxes 700, the scene manager 110 culls boxes which are occluded by the "tip" of the z-pyramid and sends the remaining boxes to the geometric processor 120..."*).

20. Claim 17 is met by the combination of Greene et al and Schaufler et al, wherein Greene et al discloses "a high resolution Z-buffer connected to said second visibility test module" (*lines 33-39 of column 7: " Both the culling stage 130 and the z-buffer renderer 140 have their own dedicated depth buffers, a z-pyramid 170 in the case of the culling stage 130 and a conventional z-buffer 180 in the case of the z-buffer renderer 140. Preferably, the z-buffer 180 and the finest level of the z-pyramid 170 have the same resolution and the same arrangement of image samples."*).

21. With regard to claim 18, Greene et al discloses a low resolution Z-buffer as shown with respect to claim 16, and Greene et al discloses using bounding boxes to determine visibility lines 63-66 of column 11: "Within Process Batch of Boxes 700, the scene manager 110 culls boxes which are occluded by the "tip" of the z-pyramid and sends the remaining boxes to the geometric processor 120..."; however, Greene et al does not expressly disclose values stored to the low resolution Z-buffer are calculated in the occlusion fusion cache. Schaufler et al discloses using occlusion fusion (*sixth paragraph of section 1*) to resolve visibility (*1<sup>st</sup> paragraph of section 4.5: "Occlusion of the original objects is determined by inserting their bounding boxes into the tree and checking that all the voxels they overlap are hidden."*).

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22. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to further modify the combination of Greene et al and Schaufler et al to utilize the occlusion fusion cache to calculate low resolution Z-values. The motivation for doing so would have been to improve the performance of visibility determination as suggested by Schaufler et al in the Abstract (emphasis added): "We demonstrate the applicability to visibility preprocessing for real-time walkthroughs and to shadow-ray acceleration for extended light sources in ray tracing, with significant acceleration in both cases." Therefore, it would have been obvious to combine Greene et al with the teachings of Schaufler et al to obtain the invention specified in claim 18.

**23. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,480,205 to Greene et al in view of U.S. Patent No. 6,720,964 to Fowler et al.**

24. With regard to claim 6, Greene et al discloses an "occlusion buffer" (*lines 7-9 of column 14: "Geometric information computed for a polygon by Transform & Set Up Polygon 900 is stored in a tiling record 5000 containing the following information."; lines 50-58 of column 9: "In step 304 of Render Polygon List 300, the culling stage 130 processes these records using procedure Tile Polygon List 800, which tiles each polygon into the z-pyramid 170 and determines whether it is visible."*), as well as the limitations recited in parent claim 1. Greene et al does not disclose compression. Fowler et al discloses compressing occlusion data (*lines 12-14 of column 4: "...the compression block 36 attempts to compress the Z data prior to storage in the Z buffer 40"*).

25. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to incorporate a step of compressing the occlusion data as taught by Fowler et al in the

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method and system disclosed by Greene et al. The motivation for doing so would have been to reduce the storage requirements for the occlusion data. Therefore, it would have been obvious to combine Greene et al with Fowler to obtain the invention specified in claim 6.

26. **Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,480,205 to Greene et al in view of Gernot Schaufler, Julie Dorsey, Xavier Decoret, François X. Sillion, "Conservative Volumetric Visibility with Occluder Fusion," July 2000, Proceedings of the 27th Annual Conference on Computer Graphics and Interactive Techniques, p.229-238 (Schaufler et al) in view of U.S. Patent No. 6,720,964 to Fowler et al.**

27. With regard to claim 13, the combination of Greene et al and Schaufler et al disclose the limitations of parent claim 9. Furthermore, Greene et al discloses an "occlusion buffer" (*lines 7-9 of column 14: "Geometric information computed for a polygon by Transform & Set Up Polygon 900 is stored in a tiling record 5000 containing the following information."; lines 50-58 of column 9: "In step 304 of Render Polygon List 300, the culling stage 130 processes these records using procedure Tile Polygon List 800, which tiles each polygon into the z-pyramid 170 and determines whether it is visible."*). Greene et al does not disclose compression. Fowler et al discloses compressing occlusion data (*lines 12-14 of column 4: "...the compression block 36 attempts to compress the Z data prior to storage in the Z buffer 40"*).

28. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to incorporate a step of compressing the occlusion data as taught by Fowler et al in the method and system disclosed by the combination of Greene et al and Schaufler et al. The motivation for doing so would have been to reduce the storage requirements for the occlusion

data. Therefore, it would have been obvious to further modify the combination of Greene et al and Schaufler et al with Fowler to obtain the invention specified in claim 13.

***Response to Arguments***

29. The rejection of claim 5 under 35 U.S.C. 112, second paragraph, has been withdrawn. The rejection under 35 U.S.C. 101 has been withdrawn.

30. With regard to the rejections under 35 U.S.C. 102 (e), Applicant's arguments filed 21 May 2007 have been fully considered but they are not persuasive.

31. Applicant's arguments with respect to the first visibility test do not appear to be based on the Office's rationale for rejecting the limitation in the claims. In the remarks, Applicant has alleged that the first visibility test of Greene et al. follows the culling stage. In the Office Action dated 19 December 2007, lines 13-17 of column 12 describing step 702 were cited as corresponding to the first visibility test, where step 702 is shown in Figure 7 as being performed before the culling stage as evidenced by step 704, which "outputs records to culling stage." While Applicant relies on the argument that Greene et al. does not perform a test using a "low precision Z-buffer" before the "culling stage," it is submitted that the terms "low precision Z-buffer" and "culling stage" are employed by Greene et al. and the language "culling stage" is not recited in the claims. In Greene et al., the test disclosed in lines 63-66 of column 11 uses the "tip of the z-pyramid," which is described as being stored at low precision in lines 52-55 of column 7: "Since z-values in the z-pyramid 170 are stored at low precision, each value represents a small range of depths." With these points in mind, Applicant is encouraged to review the citations provided as the rationale for rejecting the first visibility test recited in the pending claims.

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32. Applicant's arguments regarding the visibility tests emphasize that Applicant's method and system use a low precision Z-buffer. In response, it is submitted that the visibility tests described by Greene et al. in lines 50-58 of column 9 also use a low-precision z-buffer (*lines 46-48 of column 7*: "...z-values are stored at low precision (for example, 8 bits per z-value) in order to conserve storage and memory bandwidth..."). It is noted that Applicant does not reference specific claim limitations with respect to elements in Greene et al. that were cited in the rejection presented in the Office Action dated 19 December 2007. If Applicant intends these remarks to apply to all pending claims where a second visibility test is mentioned, then Applicant is also reminded that although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). In the Office Action dated 19 December 2007, the Examiner addressed the limitation of a "low resolution z-buffer" recited in claim 8 by citing that Greene et al. defines a z-pyramid with "coarser levels" analogous to a low resolution z-buffer in lines 56-62 of column 6 (see also lines 25-29 of column 7). With respect to claim 17, Greene et al. discloses "a high resolution Z-buffer connected to said second visibility test module" (*lines 33-39 of column 7*). For at least these reasons, Greene et al. discloses the first and second visibility tests.

33. Applicant's assertions regarding comparisons of the performance of the method disclosed in the Greene et al. reference with that of the present invention are noted, but do not distinguish the claimed invention from the teachings of Greene et al.



***Conclusion***

34. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. U.S. Patent No. 5,579,454 to Billyard discloses storing primitives and multiple occlusion tests. U.S. Patent No. 6,246,415 to Grossman et al shows an occlusion culling system and method that employs bounding boxes and occlusion buffers. U.S. Patent No. 6,525,726 to Xie et al discloses two visibility tests and storing occlusion data.

35. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M. Repko whose telephone number is 571-272-8624. The examiner can normally be reached on Monday through Friday 8:30 am -5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on 571-272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JMR

  
ULKA CHAUHAN  
SUPERVISORY PATENT EXAMINER